The Odor Stick Identification Test for the Japanese (OSIT-J): Clinical Suitability for Patients Suffering from Olfactory Disturbance

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Introduction

Various olfaction tests are used clinically in the world. In Japan, T&T olfactometry and the intravenous olfaction test, the Alinamin® test, are used as a standardized olfactory test in otorhinolaryngology clinics (Zusho, 1983; Furukawa *et al.*, 1988). In Western countries, the University of Pennsylvania Smell Identification Test (UPSIT), the Cross-cultural Smell Identification Test (CC-SIT) and Sniffin' Sticks are used (Doty *et al.*, 1984, 1996; Daum *et al.*, 2000). While each test has some advantages, it has some drawbacks, especially when it is applied to the Japanese people (Kobayashi *et al.*, 2004). To solve these problems, a new smell identification test, the Odor Stick Identification Test for the Japanese (OSIT-J), has been developed in Japan (Saito *et al.*, 2003). We examined the suitability of the OSIT-J in patients with olfactory disturbance.

Materials and methods

A total of 197 patients suffering from olfactory disturbance (84 men and 113 women, 54 ± 17 years old, 12–85 years old) were examined. The OSIT-J includes 13 kinds of odor items familiar to Japanese people (curry, gas for cooker, perfume, Japanese cypress, Indian ink, menthol, nattou/sweat socks, rose, putrid smell, wood, roasted garlic, condensed milk, Japanese orange) (Figure 1A). The procedure for the OSIT-J has been described in previous reports (Saito *et al.*, 2003). The patients choose an answer among four prepared odor names, one of which is correct, plus 'detectable but not recognizable' and 'odorless'. We calculate odor identification rate and diagnose their olfactory recognition ability.

Subjective symptoms from normosmia to anosmia ranged over five degrees of scores (Kobayashi *et al.*, 2004). The procedures for T&T olfactometry and the Alinamin test are detailed elsewhere (Zusho, 1983; Furukawa *et al.*, 1988; Kobayashi *et al.*, 2004).

All the numerical data were expressed as means ± SD. Spearman's rank correlation was calculated to examine correlations between the data, which were regarded as significant when $P < 0.05$.

Results

There was a statistically significant correlation between odor identification rate on the OSIT-J and subjective symptom scores of olfactory disturbance ($|r_s| = 0.795$, $P < 0.0001$, Figure 1B). Similarly, the result on the OSIT-J correlated closely with that on T&T olfactometry ($|r_s| = 0.802$, $P < 0.0001$, Figure 1C). This strong correlation was shown in every generation. In every patient treated for olfactory disturbance, odor identification rate on the OSIT-J could reflect the grade of recovery from the disturbance as recognition threshold on T&T olfactometry.

The odor identification rate on the OSIT-J moderately correlated with both latency ($|r_s| = 0.491$, $P < 0.005$) and duration ($|r_s| = 0.578$, $P < 0.005$) times of the Alinamin test.

The time required to perform the OSIT-J is 9 ± 3 min ($n = 79$). This time is not correlated with patients' age.

The total odor identification rate on the OSIT-J was $36 \pm 34\%$ in patients with olfactory disturbance. Recognition of the Japanese orange odor showed the greatest tendency to be impaired in patients with olfactory disturbance, while menthol showed the least tendency to be impaired, compared with the results of the same study in normal subjects (Saito *et al.*, 2003) (Figure 2).

In the OSIT-J, the individual odor items whose identification rates were highly correlated with the subjective symptom scores and the recognition threshold on T&T olfactometry were the menthol, curry and perfume odorants, while the items showing the lowest correlation were the gas and Japanese cypress odorants (Figure 3). When the odor items were removed from the 13-item OSIT-J in order of correlation with the symptom scores or T&T olfactometry (lowest first), the odor identification rate on the item-subtracted OSIT-J kept high correlation coefficients with the symptom scores or the recognition threshold on T&T olfactometry. Of note, the correlation coefficients regarding the 3- to 5-item OSIT-J are as high as those regarding the 13 item-OSIT-J.
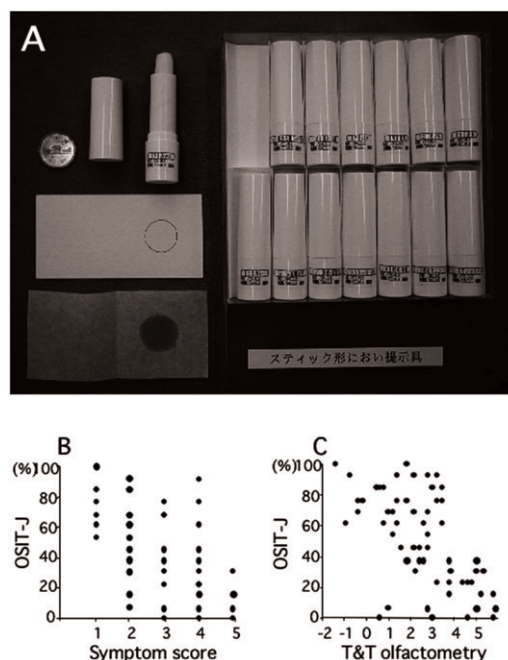

Figure 1 (A) A photograph of the OSIT-J. **(B, C)** Correlations of identification rate on the OSIT-J with subjective symptom scores ($|r_s| = 0.795$) and recognition threshold on T&T olfactometry ($|r_s| = 0.802$), respectively ($n = 120$, $P < 0.0001$).
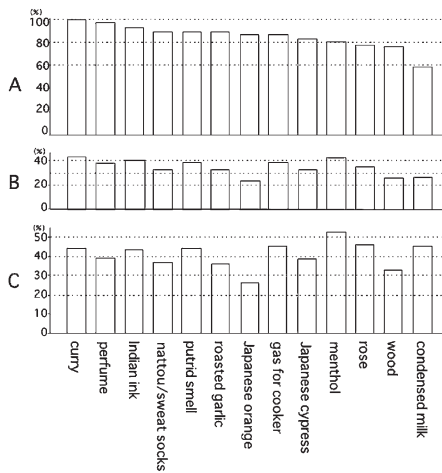
Figure 2   An odor identification rate of each item on the OSIT-J. **(A)** Data from 178 normal subjects reported previously (Saito *et al.*, 2003). **(B)** Those from patients with olfactory disturbance in this study (*n* = 120). The total odor identification rate was 36 ± 34%. **(C)** A ratio of the results from the patients with olfactory disturbance to those from the normal subjects.
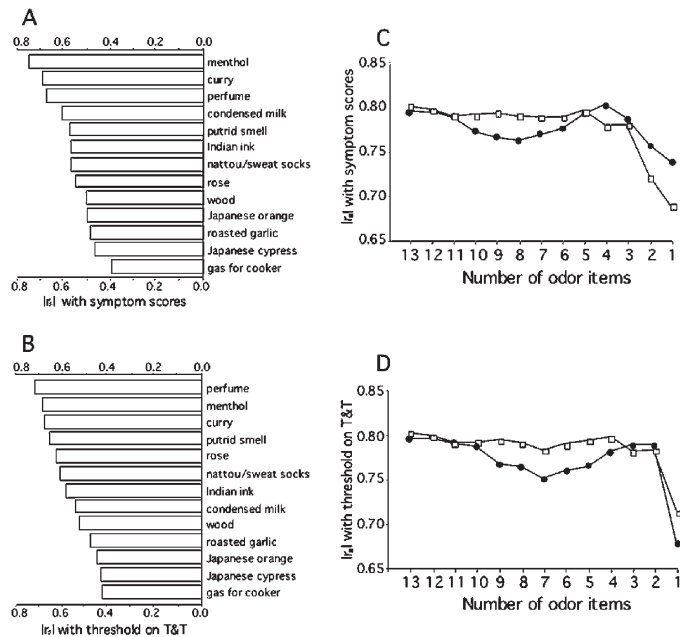

Figure 3   **(A, B)** A series of correlation between identification rate of each odor item on the OSIT-J and the grade of symptom scores of olfactory disturbance (A) or recognition threshold on T&T olfactometry (B), respectively. **(C, D)** Variations in correlation coefficients between the item-reduced OSIT-J and the subjective symptom scores or the recognition threshold on T&T olfactometry when odor items were subtracted from the OSIT-J in order of low correlation shown in (A) and (B), respectively. Closed circles shows correlation coefficients between the item-reduced OSIT-J and the symptom scores and open squares shows those between the item-reduced OSIT-J and the recognition threshold on T&T olfactometry. *n* = 120, *P* < 0.05.

We calculated the odor detection rate on the OSIT-J based on the number of times patients answered other than 'odorless'. This strongly correlated with the detection threshold on T&T olfactometry ($|r_s|$ = 0.776, *P* < 0.0001). This strong correlation was consistent

over the various generations. The degree of separation between olfactory detection and recognition rates on the OSIT-J was significantly correlated with that between olfactory detection and recognition thresholds on T&T olfactometry.

Discussion and conclusion

The present study showed that the OSIT-J is suitable for clinical examination for Japanese patients with olfactory disturbance since this test closely reflected the subjective symptoms of olfactory disturbance and the results on T&T olfactometry regardless of age. In addition, the test only takes a short time to perform.

The Alinamin test is known to correlate with the prognosis of olfactory disturbance (Furukawa *et al.*, 1988). Therefore, our results showed that the OSIT-J might be used to examine prognosis of olfactory disturbance, although we could not directly examine the correlation between results on the OSIT-J and the actual olfactory prognosis in this study.

We showed that the OSIT-J could be further simplified. Our results showed that recognition of the menthol odor tends not to be impaired in patients with olfactory disturbance while the orange one does tend to be impaired, on the basis of comparison with the normal subjects. In general, it is undesirable that an item that is difficult to impair be involved in the test kit for detection of disturbance. Our other results showed that we can reduce the number of odor items to a minimum of 3–5. We recommend that the simplified OSIT-J consists of five kinds of odor items: perfume, curry, putrid smell, condensed milk and rose. We believe that this simplified OSIT-J is suitable for a screening test or a physical examination at a busy doctor's office or clinics.

We have shown that OSIT-J can be used as a smell detection test. It is known that this changes in smell discrimination are observed in early stages of Alzheimer's and Parkinson's diseases. Some previous studies have already reported that an olfaction test is useful for screening of these diseases (Daum *et al.*, 2000; Chan *et al.*, 2002; Kier and Molinari, 2003). Therefore, we expect OSIT-J similarly to be useful as a screening test for them.

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